Incorporating "The Illuminating Engineer."

Light and Lighting

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Principal Contents:

Must One Sit in Darkness?

INTEREST in this question—as applying to theatres and picture cinemas—is renewed by the paper recently read by Mr. H. C. Weston and Mr. E. Stroud before the I.E.S. and summarised in our last issue (Jan. 1939, p.5).

In a Report to the L.C.C., presented in an Appendix to the paper, an illumination of not less than 0.05 foot-candles throughout the auditoriums of cinemas is specified. This is, of course, *a minimum*—and yet far higher than is found in many cinemas to-day. We have no doubt that if the lighting were judiciously designed, with complete avoidance of dazzle, and with reasonable care to avoid stray light on the screen, ten times this value might well be provided, with comfort to the audience and with advantage to the appearance of the picture. Indeed, the fact that the severe contrast between the bright screen and the surroundings was somewhat reduced should enhance vision and lessen eyestrain.

The truth is that the gloom in which audiences habitually sit, both in theatres and in cinemas, is a relic of the days when candles were used for footlights and "moving pictures" were scarcely bright enough for visibility. There is no need for such obscurity to-day—nor do the public really desire it.

The Report on Factory Lighting

We are presenting (see pp. 26-30) a full summary of the discussion on the recently issued report of the Departmental Committee on Lighting in Factories, which was discussed with such gusto at the meeting of the Illuminating Engineering Society on January 17. In ordinary circumstances the introductory address leading to the discussion of an official report is apt to be somewhat dry. It was a happy thought, therefore, to distribute this duty amongst four speakers, Mr. H. C. Weston, Mr. A. E. Iliffe, Mr. G. Chelioti, and Mr. R. S. Daniel, with Mr. R. O. Ackerley as a species of Clerk of the Court. The four speakers adopted quite different outlooks—those of a member of the committee, a factory manager, an expert responsible for installing lighting, and an administrator of the Factory Act—and several of them, Mr. Chelioti in particular, infused a certain humour and liveliness to their remarks which prevented the proceedings becoming dull. They covered the ground so fully that there was not perhaps a great deal of scope left for the audience. Whilst the discussion served a most useful purpose in elucidating the report, it did not reveal any very startling fundamental criticism—a tribute to its moderation and soundness. Members present were glad to welcome back the president (Mr. Percy Good) from his visit to Australia, and acclaimed his remarks on the broad and enlightened attitude adopted by the Chief Inspector of Factories, Sir Duncan Wilson, in consenting to preside over this meeting.

Lighting and the Electrical Engineer

It is encouraging to find papers of merit dealing with lighting being read before students' societies. A good example was afforded by that read by Mr. J. B. Harris before the London Students' Sections of the I.E.E. on January 20. In his opening remarks he pointed out that—in contrast with the view apt to be entertained by supply engineers—there is more opportunity for development in domestic lighting than in connection with heating and power. A definite saturation limit is set to the latter by practical requirements, whereas in most houses not only is the standard of light still far below the advantageous value, there are possibilities of great further development in creating artistic effects.

Reviewing recent developments in illuminating engineering, Mr. Harris contested the view sometimes held by the electrical engineer that the application of electricity to lighting is a simple matter, to be treated on rule of thumb lines. He described the lumen method of making calculations, but emphasised that good lighting is not merely a matter of foot-candles. He summarised recent developments in electric discharge lamps, pointing out the possibilities of fluorescence in converting non-luminous energy into light.

Mr. Harris remarked on the tendency towards using indirect lighting in modern offices, the belief being that increased expenditure of energy for a given illumination is to some extent offset by greater ease of vision. He suggested, however, that in lighting board and conference rooms an effort should be made to eliminate a possibly "lifeless" effect by introducing supplementary local lights, such as wall brackets, etc.

The remainder of the address dealt mainly with street lighting and floodlighting, industrial and aesthetic applications of the latter being discussed. In conclusion the author urged that consulting electrical engineers should recognise the importance of illuminating engineering, either co-operating with a specialist in lighting or arranging for one of his staff to have special knowledge of this subject.

I.E.S. Meetings

N.B. *Unless otherwise announced all meetings commence at 7 p.m.*

LONDON.

Feb. 15th. Maintenance of a Lighting Installation (J. FLETCHER, of Montague Burton Ltd.); *Charing Cross Hotel, Strand, W.C.2.*

Feb. 28th. Lighting of the Modern Cinema (T. P. BENNETT); *E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2.*

Mar. 7th. Some Uses of Glass in Illumination (R. F. TAYLOR and K. CHEESMAN); *Institution Mech. Engrs., Storey's Gate, Westminster, S.W.1.*

Mar. 14th. Annual Dinner. *Trocadero Restaurant, Piccadilly Circus, W.1.* **(6.45** for **7.30 p.m.)**

Mar. 28th. A Debate on Illuminated Signs (J. LANGDON, C. WILLIAMS-ELLIS and HUMPHREY BAKER); *Tudor Room, Caxton Hall, Caxton Street, S.W.1.*

LEEDS.

Mar. 13th. The Economics of Factory Lighting (W. F. POGSON); *The Electricity Showrooms, The Headrow.*

BIRMINGHAM.

Mar. 10th. Informal Dinner and Social Evening.

GLASGOW.

Mar. 15th. Annual General Meeting and Paper on Louvre Control. *19, Gordon Street.* **(7.30 p.m.)**

DUBLIN.

Mar. 21st. Airport Lighting. *Engineer's Hall, 35, Dawson Street.* **(6.30 p.m.)**

Artificial Lighting of Schools

A useful report on the above subject appears in the last issue of the "Transactions of the Illuminating Engineering Society" (January, 1939). The committee, over which Mr. W. J. Jones presided, had the advantage of co-operation of representatives of the Board of Education, the London County Council, and the National Institute of Industrial Psychology. The committee recommends values of illumination of 8-12 ft.c. in classrooms and laboratories, 5 ft.c. in dining rooms, 3 ft.c. in cloakrooms, and 1 ft.c. in corridors. Blackboard illumination should be 50 per cent. above the value at desk level. Special conditions are prescribed for classrooms for myopic children. With a view to avoiding glare a height of suspension of not less than 9 ft. is desirable. Below this height the brightness should not exceed 1 candle per sq. in., and above it (9-15 ft.) 2½ candles per sq. in. (average). The avoidance of glazed surfaces, liable to give rise to reflected glare, is advised. Books for the use of children should also preferably be printed on paper free from glaze. The use of semi-indirect and indirect lighting, the adoption of light colours for walls and ceilings, and the use of light-coloured window blinds are recommended in order to avoid the possibility of troublesome shadows. Classrooms of usual size (i.e., not less than 480 sq. ft.) should, in general, be lighted by at least four fittings, except where semi-indirect or indirect fittings are used. Where school playgrounds are kept open after dark an illumination at ground level of about 1 ft.c. should be provided by means of floodlights. In order to provide for the operation of optical lanterns an electric plug point should be installed in all schoolrooms. Other hints relate to the separate control of lighting fittings near windows and remote from them, and the importance of effective maintenance. Under unfavourable conditions the available illumination may be reduced by 20-30 per cent. in six weeks. Schools should, therefore, be redecorated at intervals of not less than five years, and all lamps and fittings should be cleaned and overhauled every month.

Road Administration

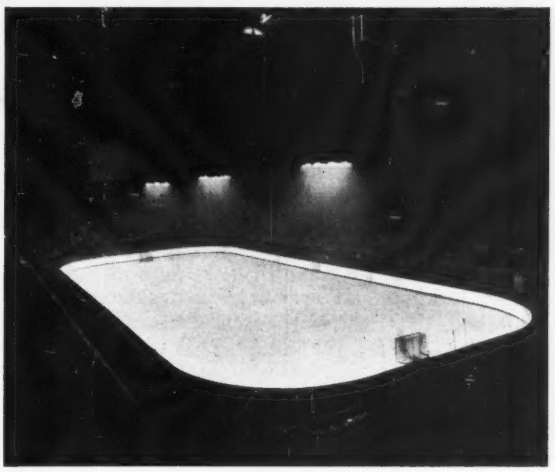
An instructive lecture on the above subject was recently read by Sir Leonard Browett at the London School of Economics. He recalled how the Roman roads passed through a period of deterioration until 1285 when the Statute of Winchester initiated proper road administration. It was, however, the industrial revolution which really set in motion road legislation, involving the formation of turnpike trusts with power to levy tolls. During the nineteenth century responsibility for road maintenance passed gradually from local authorities to county councils. The turnpike trusts were terminated in 1895. In the twentieth century road transport, competing with the railways, raised new problems, resulting in the Road Improvement Act, (1909), the Road Fund (1920), and the Local Government Act (1929). Finance and future developments have been major problems. The Ministry of Transport has tended to use local authorities as its agents. Problems of road construction have been studied scientifically. One could wish that one essential to the proper use of roads—lighting—could be kept more fully in mind by those concerned with road administration, and its development likewise treated on a national basis.

I.E.S. ANNUAL DINNER

Trocadero, March 14.

Applications for tickets should now be sent in without delay, seats are already being allotted and tables arranged.

Lighting a Skating Rink



The lighting of skating rinks, more especially those on which spectacular displays take place, is a much more elaborate affair than was usual a few years ago. We illustrate above the appearance at night of the rink at Wembley Stadium, where the finals of the National Figure Skating Championship recently took place. The installation, the first of its kind on such a large scale, utilises a blend of filament lamps and electric discharge lamps. Twenty-seven 1,500-watt Cosmos gas-filled (filament) lamps and eighteen 400-watt Metrovick mercury discharge lamps were used, giving an average illumination on the rink of 25 ft.c. This high illumination and the special quality of the light enable the figures of skaters to be revealed in a most effective manner against the background of blue-white ice. Whilst the introduction of the light from discharge lamps thus contributes to the effect of the spectacle, the combination with filament lamps is helpful in eliminating any possible stroboscopic effect such as might arise with the mercury lamps alone.

Designing for Brightness

It was formerly assumed that the solution of most problems in illuminating engineering involved merely the provision of a certain illumination. Now, however, the lighting expert is intimately concerned with the resulting conditions of *brightness*. In street lighting the road surface brightness is now regarded as a factor of vital importance. The same applies equally to many problems in decorative lighting—as was well illustrated at a recent meeting of the I.E.S. Section concerned with this topic. One of the difficulties mentioned by Mr. A. W. Beuttell was the production of images of lamps, visible in a cove or ceiling when such surfaces are treated with glossy paint—a familiar trouble in cornice lighting. The best remedy is to cover the "image areas," usually well defined, with matt paint. It is, however, possible so to design an elliptical cove that the images would all fall above the eye level. Another problem is the design of laylights, suitable for admitting daylight as well as being illuminated by artificial light after nightfall. The material should appear reasonably evenly illuminated and give the desired diffusion of light—a condition in itself not always so very easy to secure. But the glazing should also retain an element of "sparkle," an effect depending both on the choice of material and the sources of light, and on the distance of observation.

Factory Lighting

The Fourth Report of the Home Office Departmental Committee on Lighting in Factories is Discussed Informally at a Meeting of the Illuminating Engineering Society

The meeting of the Illuminating Engineering Society, held on January 17, attracted a record attendance, the lecture theatre of the Institution of Mechanical Engineers being packed to overflowing with members of the Society and visitors who had been attracted by the very topical nature of the subject: the recently issued report of the Home Office Committee on Factory Lighting. The arrangements for the meeting were made by the Industrial Lighting Section of the Society, and after the more formal business had been transacted the audience listened to a public debate by four members of the Section under the chairmanship of Mr. R. O. Ackerley. This was followed by a general discussion.

In opening the proceedings Dr. English welcomed back to this country the Society's President, Mr. Percy Good, who had recently returned from Australia and New Zealand, where he had been advising the Governments on the subject of standardisation. Mr. Good, whose assumption of the Chair was loudly applauded, first expressed his appreciation of the honour the Society had conferred upon him by electing him as its president, and he then, after the formal business had been transacted, said that they were fortunate in having with them Sir Duncan Wilson, a Past President of the Society and now H.M. Chief Inspector of Factories. As the purpose of the meeting was to discuss the recommendations of the Report of the Departmental Committee, of which Sir Duncan was Chairman, he proposed to vacate the chair and ask Sir Duncan to preside over the remainder of the proceedings.

In his opening remarks Sir Duncan Wilson was careful to emphasise that the recommendations in the report had, in themselves, no mandatory force; they were recommendations to the Secretary of State, and there was consequently every opportunity for criticism and suggestion before statutory regulations were made. The Report was then discussed from four different points of view, taken respectively by Mr. H. C. Weston, who gave a critical summary of the contents of the Report; Mr. G. Chelioti (Chairman of the Works Managers' Association), who discussed it from the factory manager's standpoint; Mr. A. E. Iliffe, who dealt with it as an illuminating engineer; and Mr. R. W. Daniel (Secretary of the Committee), who considered the subject from the point of view of the Home Office.

General Neglect of Lighting in Factories Except at Workplaces.

After a brief reference to the steps which the Committee had taken to inform themselves as to existing practice in factory lighting (taking evidence, visiting factories, and witnessing demonstrations to elucidate certain special points), Mr. Weston said that the need for statutory regulations for factory lighting arose chiefly from neglect to provide *adequate* lighting of parts of factories which surrounded and gave access to actual workplaces, and to provide *suitable* lighting of these parts, as well as at the workplaces themselves. At the latter, sheer necessity usually compelled the adoption of standards of illumination which were less open to criticism than those found in surrounding areas and in corridors, staircases, and other parts of factories used by workers in the course of their employment.

It was felt, therefore, that the most immediate need was for the imposition of minimum standards of illumination for general areas of factories, irrespective of the illumination required actually on the work, and for regulations framed to secure the suppression of avoidable glare, undesirable shadow, and the use of unsuitable light sources. Mr. Weston pointed out that, pending further consideration of the problems involved in regulating the lighting of special processes, power to deal with cases which might be the subject of definite complaint existed in virtue of sub-section (1) of Section 5 of the 1937 Factory Act.

Recommended Values of Illumination.

Of the three recommendations made concerning the minimum illumination to be required in parts of factories, the first referred to working areas, and specified a minimum illumination of 1 ft.c. at floor level, or at 3 ft. below the level at which work is carried on, without prejudice to the illumination required for the work itself. This, said Mr. Weston, applied to all factories, including foundries. He said that no one would be surprised that the illumination now recommended was substantially higher than the very low value originally proposed for working areas in 1915, a value dictated too much by the prevailing practice and not at all adequate even as a minimum. Fortunately the cost of lighting per foot-candle had decreased so much that the cost of complying with the present recommendation of the Committee should be no more than would have been the cost of complying with the 1915 recommendation at that time.

The object of the regulation recommended was, of course, to secure a reasonable minimum of general lighting in workrooms; the illumination on the floor, though important in itself, was specified chiefly because it was the most convenient index of this.

For interior parts of factories (other than working areas) used by persons employed, an illumination not less than 0.5 ft.c. at floor level was recommended as a legal minimum.

For exterior parts of factory premises the recommendation was for a minimum illumination of 0.1 ft.c. at ground level or other level of employment or passage, without prejudice to the illumination required for the actual work carried on, or for the adequate lighting of dangerous parts and places. Since insistence upon this standard in every part of large yards and regular roadways might in some circumstances be unnecessary, it was proposed that the Chief Inspector of Factories should have power to approve a lower standard in appropriate cases.

Recommendations Regarding Glare.

Recommendations (4, 5, and 6) had for their object the reduction of glare, and, if they were accepted and embodied in regulations made under sub-section (2) of Section 5, compliance with them was likely to involve some modification of a large number of installations. Recommendation (4) applied to all general light sources mounted less than 16 ft. above floor level, and stated that no part of the source or fitting having a brightness greater than ten candles per square inch should be visible to any person whilst normally employed within 100 ft. of the source unless it was at an angle of elevation from the eye greater than twenty degrees.

Mr. Weston, pointing out that glare was largely a matter of contrast, said that in view of the present tendency to provide better general lighting, with consequent higher background brightness, the Committee felt justified in raising the permissible brightness of sources visible at angles of elevation less than twenty degrees from five to ten candles per square inch. It was recommended, however, that local light sources—irrespective of their brightness—should be

completely screened from the eyes of every person employed at a normal working place by some effective means, such as suitable shades of opaque material.

Recommendation (6) referred to glare due to light reflected from smooth or polished surfaces.

Shadows and Flicker.

Recommendation (7) called for the avoidance, "as far as reasonably practicable," of shadows which might prejudice the safety of or cause discomfort to any person employed, and recommendation (8) was for the prohibition of light sources which flickered or underwent abrupt changes in candle-power so as to interfere with the safety or efficiency of persons employed. This was not intended to apply to electric discharge lamps operating on a supply frequency of fifty or more cycles per second, unless it was established that their use created discomfort or dangerous optical illusion.

Date of Enforcement.

The Committee recommended that regulations based on their proposals should come into force on July 1, 1939, and that the Chief Inspector of Factories should have power to grant exemption from certain requirements in special cases where compliance was clearly impracticable.

Illumination for Various Processes.

Dealing with the question of adequate illumination for the great variety of industrial tasks involving discrimination of detail, Mr. Weston said that the Committee felt that legal minima were necessary, but they were not, at present, prepared to make actual recommendations. Attention was drawn to published tables of recommended values of illumination, such as that prepared by the Society, and the inference might fairly be drawn that factories in which these standards of illumination were maintained would be providing sufficient lighting as required by sub-section (1) of Section 5. The Committee specially emphasised that legal minima should not be regarded as standards of good practice; it was always desirable that the latter should be adopted rather than the former.

The Committee, while not in favour of a classification like that in the Third Report, thought it possible that some method might be found whereby the illumination necessary for any process could readily be determined, and this would be of great value to industry, apart from its use for the establishment of legal standards of illumination. Obviously any such method would have to be based on general relations existing between the variables involved, namely the work, the illumination, and the response of the worker—and much further investigation was necessary.

It had been suggested to the Committee that the ratio of the "just comfortable" to the "least possible" working illumination might be approximately constant for all visual tasks.

Any such method would, of course, be open to a good deal of criticism, and the subject was a fruitful one for discussion.

The Reactions of the Factory Manager.

The next speaker was Mr. G. Chelioti, who prefaced his remarks with the complaint that, while the Departmental Committee had consulted the various technical bodies concerned with lighting, they had not, apparently, consulted the factory managers either collectively or individually.* Presumably, therefore, the Harley Street precedent was being followed: when the consultants had finished the patient was wheeled into the operating room so that the surgeons could "get on with him." (Laughter.) Continuing, Mr. Chelioti said that on the present occasion he had a dual personality, firstly as a representative of a class who, by implication, required education, guidance, and, if need be, coercion towards certain standards, and, secondly, as a convert of some long standing to whom those standards seemed remarkably modest.

In the first guise, while he would not attempt to justify the cave-dwellers, those people still needing compulsion to provide their workers with 1 ft.c. in their workshops, he wished to look at the report with the eyes of the non-specialist manager needing his statutory guidance in the simplest possible terms. For him it was to be hoped that the Home Office would, if these recommendations became law, produce some kind of very simple explanation which would enable him to comply with the law with certainty and ease. If such a man read the Report as it stood he was going to have a headache. The modern factory manager had to be a little of so many things that one should be merciful and spare him the final tribulation of qualifying in illuminating engineering.

For instance, paragraph (12) and recommendation (1) could be simplified by leaving out any reference to minimum "general" illumination, and "without prejudice to the illumination required," saying baldly that the illumination should not anywhere fall below 1 ft.c.

To avoid any implication that 1 ft.c. was adequate for actual work, it would be well to add a separate and emphatic reminder that much higher levels were needed for that purpose and should be provided pending further statutory regulations. In the same way recommendation (3) might be reduced to the admirable brevity of No. (2).

Mr. Chelioti said that the non-specialist was going to hate No. (4) about glare, which invited him to the further study of surveying or navigation, so that he could determine when his cut-off fell below 20 degrees. He earnestly begged the drafters of the regulation to confine themselves to or interpret their angles in simple linear terms.

Recommendation (8), with its rider about discharge lamps, was the last straw; in how many of the 150,000 or more factories in England was the blessed word "stroboscopic" familiar?

The Impressions of the More Enlightened.

Returning with some relief to his own point of view, Mr. Chelioti thanked the authors for a Report which was not only convincing but very readable for those having the necessary knowledge. As he was in his own person a convert who seemed in some ways to have outstripped his own priesthood, he would assail it chiefly for its timidity. His own factories had for many years been equipped in most departments for a nominal 10 ft.c. general lighting at the 3-ft. level, and this gave, in practice, from 5 to 7 ft.c. at floor level in the worst and 9 to 14 ft.c. in the best cases. One foot-candle as a battle-cry, therefore, did not sound very rousing.

If, however, Factory Inspectors and factory engineers were to grope about in the gloom in order to decide whether or not there was to be a prosecution, would someone please produce a cheap, accurate, portable, and foolproof light meter reading between 1.0 and 0.1 ft.c.?

The speaker said that he felt rather dubious about recommendation (6). It might be possible to work on or inspect flat smooth surfaces in a strong light without seeing reflections, but cylindrical and spherical surfaces, which were probably far the commonest, would defeat this proviso. Indeed, in very small work (e.g., fine wires) the eye might depend mainly on these reflections. He missed any clear guidance on diversity of illumination as a possible source of danger or fatigue, although there was a veiled reference to it in recommendation (7). A

* Editor's Note.—One of the bodies which gave evidence before the Committee was the National Confederation of Employers' Organisations.

case for which no provision at all had been made was the inspection of fine work in silhouette against a luminous background.

He liked the stress laid on stair and corridor lighting. In his experience a large number of minor accidents occurred on stairs, and though he had established no correlation with lighting he accepted its importance, adding the suggestion that high diversity was probably especially evil and very likely to exist, most staircases being lit by so few and so awkwardly placed units that a mere increase in the size of those units would often be only a very partial remedy.

Finally, Mr. Chelioti again urged on the Home Office the need for simplification and popularisation of the subject. They set themselves a fine example in their "Guide to the Factories Act" published last year. A booklet of this kind could avoid technicalities as far as possible, but ought, in his opinion, to consist largely of examples of how to fulfil the requirements, not only by generalised diagrams, but also by typical specifications for rooms of given dimensions, going into enough detail to give the reader a fair idea of cost of installation.

The Illumination for Different Kinds of Work.

The Report was discussed from the illuminating engineer's point of view by Mr. Iliffe, who said that in the opinion of most lighting engineers the Departmental Committee had not dealt with the main point, unless, of course, they considered that the points they had covered were of greater importance than sufficient and suitable lighting on the work itself.

Nevertheless they had produced a very logical Report which, if embodied in regulations, would form a guide to minimum requirements for the competent advisory expert. The Report strongly emphasised that the minima stated were lower than the desirable standards of good lighting practice, and any factory or workshop illuminated only to minimum intensities would be a monument to the failure of the lighting engineer, and the lack of efficiency of the factory executives.

The lighting expert, said Mr. Iliffe, must appreciate the special reference in the Report to the Illuminating Engineering Society's code and the E.L.M.A. tables of recommended values for various processes. It was interesting to see that in some instances the values recommended as minima in the Report of 1922 had been multiplied by four in the recommendations of 1937, and if the 3 ft.c. for fine work and 5 ft.c. for very fine work were multiplied similarly, the result would be approximately the I.E.S. and E.L.M.A. recommended values.

The Report pointed out that sufficient and suitable illumination for the work itself was one of the main requirements of the Act and must be provided. It is worth special notice that the words used were *for* the work, and not *on* the work; this illustrated the practical knowledge of the subject by the drafter of the recommendations. Vision to promote health and safety depended on more than foot-candles on the work.

The Importance of Careful Design.

Upon first perusal the actual recommendations appeared too low, although it was well known that the 1 ft.c. recommended for working areas was above some present practice. In considering the first recommendation (Clause 12 of the Report) it was interesting to lighting experts to see how it would be possible to design to the minimum recommended and yet provide a lighting installation that could be approved as sufficient and suitable when judged by the standard of illumination for the work itself.

In order to show the conservative nature of the recommendations, Mr. Iliffe gave some details of a recent installation carried out by voluntary acceptance of sufficient and suitable lighting as prescribed by the lighting expert.

The area covered was 29,820 sq. ft., and lighting was provided by an installation of 321 200-watt units, giving an average illumination on the working plane of 16.5 ft.c., with excellent uniformity and low shadow factors.

The structure of the building allowed of a mounting height of 21 ft., and to give the minimum recommended intensity at floor level the installation of forty-two units would have been sufficient. Alternatively, with a mounting height of 11 ft., 108 75-watt units would be needed, the uniformity factor being then 70 per cent. Calculation then gave a 12 per cent. increase over the floor level illumination, but the uniformity dropped by half in the worst cases, and this, of course, would not in modern practice be considered good lighting.

This example indicated where the lighting engineer had to fill in the blanks of the recommendations, but the Departmental Committee had, said Mr. Iliffe, discreetly reminded the lighting engineer of the necessity of providing suitable and sufficient illumination for the work itself and so he would have to leave the old "square" method of planning installations and adopt the light-unit positioning method.

In planning a light position layout, the engineer might meet with difficulty unless the scheduled exceptions were published very quickly, and it was to be hoped that the Factory Department would do their best in this matter. Bulkhead fittings for tunnel, corridor, and some machine lighting should be accepted as suitable, provided up-to-date methods of light diffusion were adopted. Parabolic angle fittings, elliptical angle fittings, and others were often necessary to provide illumination for the work itself.

The recommendations on surface brightness and angle of cut-off would certainly improve the standard of lighting, but the use of opal and pearl sprayed lamps needed clarifying, as it was expected that the brightness of the bottom of the bulb would exceed the ten candles per square inch, and this, of course, showed the need for defining the method by which angle of cut-off would be measured. In the past the theoretical focal point had been taken, but for pearl or opal bulbs this was not technically correct.

Mr. Iliffe thought that the exact interpretation of the clause dealing with the shading required for local lighting fittings was somewhat obscure and might with advantage be given in terms of an angle of cut-off similar to that for general lighting fittings; he suggested 30 degrees.

Diversity and Contrast.

The lighting engineer rather expected to see other points incorporated in the recommendations, particularly the diversity ratio between local lighted areas and the general lighting of the factory; a figure of 10 : 1 would probably not be regarded as unreasonable. Some remarks on diversity with regard to the recommended minima, and the suitable and sufficient lighting on the working areas might also have been incorporated; similarly a maximum diversity between the illumination inside the factory and the minimum allowed for corridors, stairways, etc., and for surrounding areas and spaces, was desirable.

It was pleasing to hear that the Factory Department might consider that the I.E.S. and E.L.M.A. recommended intensities for process lighting could be regarded as suitable and sufficient, for there might be some hesitancy amongst factory executives to replan their lighting unless this point was clarified.

The restriction of surface brightness would bring new types of fittings, and the responsibility for not exceeding the permitted surface brightness would presumably rest with the fittings manufacturers, provided correct lamps were used. This was a good thing.

as it would encourage a demand for fittings where quality, and particularly absence of glare, would take precedence over maximum light output.

Commenting on Mr. Iliffe's remarks with regard to "cut-off," Mr. Chelioti said that he could not follow the method of limiting glare by means of an angle and a minimum mounting height of 16 ft. He instanced dazzle from the sun. Mr. Iliffe, in reply, referred to the actual recommendations in the Report, and said that if these were complied with there should not be much trouble from dazzle or glare.

The Necessity for Legislation.

The fourth speaker, Mr. Daniel, recalled Mr. Bernard Shaw's remark that although things change, even civilised peoples often remain strangely insensible of that change for whole decades afterwards. As a result, old methods, modes, and so forth persist beyond conditions for which they were formulated. He thought that this reflection—perhaps re-arranged as a sonnet—might aptly summarise much of the sorrier aspects of modern industrial lighting.

At this point, Mr. Ackerley interposed. The sonnet, he said, had now been prepared. He read as follows:—

"*Lines written in sorrowful contemplation of a drop pendant lampholder.*"

How proud was he who in the first decade
Of twentieth century, in thy factory bower
Installed thee with a lamp of candle-power
At least fifteen, and ringed thee with a shade
Of white enamel, conically made.
And as its whiteness dimmed, he thee did dower
With larger lamps which seemed to come down lower
And 'neath the rim a dazzling light displayed.
To-day thou art a sin, a cause of strife,
Says Bernard Shaw, that sage of living men.
A maladjustment of our modern life,
Begone, and never show your face again.
Out-moded method shall no more be rife
Since Daniel once again has braved the den.

Mr. Daniel, continuing, said that in a very large number of factories the illumination provided was still incredibly low and in many more glare was severe. The explanation probably lay very largely in lack of access to standards of comparison. Every shopkeeper had access to the well-lit premises of his competitors, and presumably, in consequence, few shops were inadequately or badly lit. In contrast, owners and managers of many poorly lit factories rarely, if ever, entered the premises of a competitor or, indeed, any factory other than their own. It was surely in such factories that legislation was most needed and would produce most effect, for whilst it could not take the lead—that task must remain to the illuminating engineer—it could at least point the way so as to ensure that these stragglers no longer fell too far behind.

Legal Minima and Recommended Practice.

Critics of the Report had expressed disappointment at the minimum standards of adequacy proposed and some feared that these legal minima might be interpreted or upheld as recommended practice, but Mr. Daniel felt that the Committee acted rightly in putting forward definite standards to provide at least reasonable minima in every factory. Nor did he think that misinterpretation of these minima as recommended practice was likely. The Report clearly emphasised their true relation, and repeated emphasis that statutory minima could not be expected to provide the superior results of recommended practice would itself subtly promote the better standard.

Although some disappointment had been expressed at the absence of standards for fine processes, such a policy seemed, at present, unavoidable. While acceptable standards for general lighting had not proven difficult to devise, among the labyrinths of process lighting no clearly defined paths had yet been established. It should not be forgotten that fine work could not be done without great difficulty, if at all, unless comparatively adequate light was provided; it was among the coarser and commoner tasks that the need of improvement seemed, therefore, to be greatest.

Improved standards of lighting of the means of access both inside and outside the factory should also prove of considerable benefit. Approximately 25 per cent. of all factory accidents resulted from falls or stumbling over or against fixed and loose objects, and in 1937 there were 36,000 of these accidents, each involving three days' absence from work. Surely it was legitimate to assume that many would have been avoided had better lighting made perception easier.

Glare Again.

Although Mr. Chelioti was perturbed at the apparently navigational phraseology in which the glare recommendation had been framed, Mr. Daniel assured him that the introduction of an angle provided the simplest legal requirement from the point of view of legal phrasing. In the factory itself a height distance-table would, of course, suffice. In spite of years of propaganda and advertisement, the problem of glare was still very acute: the use of modern high-power lamps in obsolete drop-pendant installations was a major cause, and installation at "competitive prices" per point was another—far less excusable, since a section of the electrical trade was here wholly responsible. Only a month ago a well-known firm of high-class jewellers (clearly endowed with tremendous optimism) had sent him a Christmas catalogue, expensively and elaborately produced, and concluding with a neat photograph entitled "Craftsmen at work in our Jewellery Department." The lighting—a conspicuous feature—was appalling: the middle foreground was shared equally between an unfortunate craftsman and a 100-watt gas-filled lamp, quite unscreened. Similar lamps appeared at regular intervals along the benches. It was quite clear that the management was proud of its working conditions and remained wholly unaware of this illuminating shortcoming.

Mr. Iliffe had commented on the possibility of limiting the diversity factor by statutory provision. There were several obstacles—not the least being the selection of a suitable figure. Even if this were possible, however, it might often impose hardship in cases of intense local lighting, and must, in any event, add to the complexity of the regulations.

Cost: Administration.

Mr. Daniel then referred to the cost of complying with the recommendations. He was constantly being reminded that improvements cost money, but he felt strongly that, of all the money engulfed by factory improvement and maintenance, none showed greater return than that spent on lighting. And while it was not the duty of the Factories Act to improve efficiency of production, few could object on grounds of abstract principle to this effort to promote simultaneously the increased welfare of the workpeople and efficiency of the work.

The regulations proposed, of course, applied to all classes and descriptions of factories, and relaxation would doubtless become necessary in certain special cases. Speculation was impossible at this early stage, but the Factory Department had a reputation, of which it was justly proud, for reasonable demands and fair treatment of special difficulty. Provision of good lighting and not enforcement of regulations was, after all, the primary objective.

Air Raid Precautions.

Finally, Mr. Daniel referred to the present necessity for Air Raid Precautions. In time of war unscreened interior lighting would in general be at all times prohibited. A handbook, he said, would shortly be issued, and would recommend broadly that in factories generally preparation be made to mask in

an emergency all windows, roof lights, etc., with opaque blinds or screens, paint, or other device. This should permit the retention of adequate interior artificial lighting. Exterior lighting in a modified form would necessarily be restricted to work of national importance. There could be no doubt that the help of illuminating engineers would not be sought in vain whatever problems might arise.

Contrast Again.

Mr. Chelioti asked Mr. Daniel whether he was right in thinking that, although he might have to provide 1 ft.c. on a staircase inside a building, he need not provide more than 0.1 ft.c. if the staircase were outside. He pointed out that he could equally well break his neck on either. Mr. Daniel replied that this was again a matter of diversity. He believed that for ordinary values of artificial illumination a diversity factor of 10 to 1 was not unreasonable and that if danger points were separately guarded or marked one could safely pass from 1 ft.c. interior illumination to 0.1 ft.c. in a yard, especially as there would usually be a certain period of time for adaptation. In reply to a further question, he said that he did not think there would be any serious risk in providing very high local illumination at a workplace, even though it did present a considerable contrast to the statutory 1 ft.c. on the floor, provided that the floor in the vicinity were kept free of uncovered pits, straps, or other dangers or obstacles.

A Simple Explanatory Booklet.

The Chairman said that a leaflet was in preparation which would explain the recommendations in a simple way. It was hoped that copies would be widely circulated within a few weeks among factories throughout the country, and would tell the occupiers and owners of those factories generally where they could get advice. It might prove confusing to circulate a booklet purporting to give particulars as to how the recommended standards could be attained, as such a booklet would have to cover an enormous field, embracing every possible variety of factory.

Although many, if not most, of the factories in this country were fairly well lighted, there was a very large minority in which the lighting was distinctly poor. In his view the occupier of a small factory who was made to provide a new installation would probably go a good deal beyond the specified minima; thus, the standard achieved eventually would be a good deal higher than the specified minima, and that was one of the greatest advantages of statutory powers.

[At this point in the proceedings Sir Duncan Wilson had to leave and, on the motion of the President, a vote of thanks was accorded him for having presided and for all the work he had done in the past on behalf of the Society. In response, Sir Duncan said he looked forward to the co-operation of all the members of the Society in making future regulations a success.]

When is a Road not a Road?

The discussion was then thrown open to the meeting at large and a number of questions were asked of the four speakers. "Would the minimum recommended for outdoor yards and roads around a factory have to be provided on a roadway used occasionally during the night by a watchman?" asked Mr. H. H. Long, and Mr. Cunnington, writing after the meeting, suggested that even some of the more progressive factories would find many spots where the 0.1 ft.c. was not attained. Mr. Daniel pointed out the Committee's remark that in places with infrequent or irregular user hand-lamps might be permitted.

Bulkhead and Wall Fittings.

Dr. S. English pleaded for consideration of the bulkhead or wall type of fitting, because during the last four or six years the use of that type of fitting had extended by leaps and bounds. He asked, through Mr. Daniel, that the Home Office, when drawing up regulations based on the Report, should arrange, if possible, that the maximum brightness of ten candles per square inch could be exceeded from such fittings where the light did not shine into the eye of the operator while working.

Mr. Daniel said he felt sure the Home Office would consider the point very carefully, but he suggested that if it was agreed that glare was bad the correct procedure was to alter the fittings to bring them within the glare prevention provisions rather than to create exemption from the recommendations.

In reply to a question from Mr. F. C. Smith, he added that, in his personal opinion, the Committee intended the 20 degree cut-off to apply only to the lighting in places of work and not to places of access.

Illumination for Individual Processes.

Mr. Holmes asked if it would be possible to state the recommended values of illumination for different processes and to indicate the minima as fractions of the recommended values, instead of stating the actual statutory minimum figures. Mr. F. C. Raphael emphasised the importance of having such legal minima and pointed out that in the appendix to the Committee's Report and in a report issued by the Society absolute numerical standards were recommended.

Mr. Daniel replied that unfortunately there was at present no one really satisfactory method of determining precise standards necessary for individual processes—there was not even a common viewpoint as to what were fine and very fine processes and any attempt to define them led to endless discussion. He asked whether anyone present felt competent to advise the Committee to the precise standards necessary for individual processes.

How Regulations Will Be Made.

In reply to Mr. Iliffe, who asked how regulations concerning factory lighting were made, Mr. Daniel said that sub-section (1) of Section 5 of the Factories Act required that adequate and suitable lighting be provided in every factory from July, 1938. Under sub-section (2) the Secretary of State had power to make regulations defining suitable standards; under the powers of that sub-section the Departmental Committee was appointed, and had recommended certain standards. Before regulations could be made copies of the full draft regulations must be sent to all interested parties, who must be given the opportunity within a prescribed period to lodge complaints or objections, or to make comments pertaining to the regulations. If the complaints, etc., were substantial, an opportunity for their discussion would be arranged. In the absence of general agreement the whole question might go to arbitration; only after all such matters were cleared up would the regulations come into force.

The President congratulated both Mr. Daniel and his Department on having been prepared to face the audience in connection with the Report; Mr. Daniel's presence provided a very interesting and satisfactory example of what a Government authority ought to do. He congratulated Mr. Daniel on the ability with which he had dealt with the points raised, and also thanked Mr. Ackerley and the team he had gathered together for the purpose of the discussion upon their excellent handling of the problem.

Although some people complained about the cost of providing decent lighting, he suggested that this should properly be considered as an item in total costs of production in order to view it in the right perspective. When Factory Inspectors were faced with complaints about the cost of lighting installations they might very properly inquire what was the cost as a fraction of the total production costs.

The meeting closed with an expression of thanks to Mr. Ackerley and the four opening speakers.

The Relation between the Illuminating Engineer and the Fittings Designer

Summary of an Address given by Mr. Harold Bright to the Decorative Lighting Section of the Illuminating Engineering Society on January 24

In his address on this topic before the I.E.S. Decorative Lighting Section on January 24, Mr. Harold Bright displayed a species of family tree expressing the various ideas in the mind of a client (probably at least six simultaneously developed) of which *lighting* was the one for consideration at the meeting.

The Choice of Experts

Having determined that something must be done about lighting, the client has three methods of approach. He may go direct to the fittings designer, or he may discuss his ideas with the architect, or—the least likely course—he may consult the illuminating engineer.

Fittings designers may be divided into two groups, those who design fittings for showroom purposes, i.e., for general sale, and those who design to suit definite requirements. The former must produce designs which appeal to as large a number of people as possible and which are largely influenced by manufacturing costs. The latter usually work to architect's sketches. The client, however, will probably not see the actual designer as his enquiry will be dealt with by the sales or showroom staff, who are not usually trained illuminating engineers! His choice of a fitting, from a selection shown to him, is likely to be based on appearance rather than efficiency.

The Task of the Illuminating Engineer

Mr. Bright next considered the position when the enquiry has reached the illuminating engineer, either direct or through the architect. The part played by these various experts was also illustrated by Mr. Bright in his "family tree." The architect is in charge of the decorative scheme and his task is to balance the various decorative features and achieve unity in the whole. The illuminating engineer is concerned mainly with the adequacy and efficiency of the installation. The fittings designer takes the ideas of the client, architect, and illuminating engineer, develops them into a concrete form, and produces an article of commerce.

If an illuminating engineer is employed he will decide the method of lighting and the values of illumination, the type of distribution from the fittings, the position of points, and the size of the lamps. In doing so he must respect ideas of the architect in regard to ornamental fittings and modify them to meet the demands of good lighting. He should combine all his information in the form of a very broad specification for the use of the fittings designer, but should again consult the architect and secure his approval before passing this on. From this stage onwards the illuminating engineer would act as a liaison officer between the architect and the fittings designer.

Problems in Fitting Design

There appears to be an opening for consultants on illumination who are prepared to work in collaboration with fittings designers—not in any way to supersede them nor to offer destructive criticism, but to assist them in getting the best result from the lighting equipment to be designed.

In this connection Mr. Bright illustrated, by means of lantern slides, problems in which such co-operation is often helpful. He explained, for example, the use of scientifically contoured reflectors in order to control the indirect light from a bracket unit, the problems involved in a fitting of mammoth design, and the modification of old fittings to give new effects. A good instance of want of co-operation was afforded by a square laylight. This could easily be lighted by four lamps and the four points were installed. But then the laylight arrived with *nine* panels, giving such an unpleasant effect that ultimately the four points had to be removed and nine substituted.

Avoidance of Spottiness

Several demonstrations and pictures were designed to show simple means of eliminating spotty effects. Curves have been prepared showing the permissible spacing of lamps for varying distances from the glass. When opal glass is used it must be remembered that this surface is a good reflector as well as a good transmitter. Hence the need for supplementary reflecting surfaces behind the lamps, which also render most useful help in smoothing out spottiness. Similar problems arise when lamps are spaced for cornice lighting, especially when the surface on which the light is received has a certain amount of glossiness.

This question of the selection of wall and ceiling finishes is of considerable moment. Architects do not always realise how much the lighting scheme may be affected by an unsuitable colour or texture of the surfaces. In this connection, as well as the elimination of shadows and patches generally, the illuminating engineer can often give helpful advice as a result of his installation experience. An interesting and rather curious example mentioned by Mr. Bright is the treatment of a stippled ceiling. If this is lighted by a central fitting the effect of the shaded stippling is exaggerated, whilst if cornice lighting is used the reverse will happen. Consideration must also be paid to the danger of inconvenient reflections from polished areas immediately adjacent to the source of light, such as mirrors or polished metal work. Metal work appears lighter or darker, according to whether it is lighted from the front or seen in silhouette. Objects seen in silhouette may be highly decorative.

Dealing with miscellaneous problems in connection with fitting design, Mr. Bright illustrated how to overcome the fundamental weakness of candle-fittings lamps by concealing two pygmy lamps in each of the saucers below the sconces and also in other parts of the fitting. One can thus obtain the necessary illumination and produce alternative lighting effects without the appearance of the fitting being altered.

Limits to Brightness

Reference was next made to one familiar problem, the determination of the degree of brightness giving the best effect. Excessive brightness of diffusing glassware causes glare, too dim a unit is apt to assume an unpleasant ginger hue. It should be remembered that the permissible brightness depends very greatly on the nature of the background. Another problem touched upon was the method of assembling discharge lamps and filament lamps within the same diffusing globe so as to give the most pleasing effect.

In the concluding portion of his address he again emphasised the need for co-operation between the various experts concerned in a lighting installation. Fittings are sometimes selected or designed without due consideration of their sites. The author finally presented "eleven points" on which information is needed in order to define the duty a fittings has to perform.

Street Lighting Improvements

An eight-year contract entered into by the Llandovery Borough Council provides for improved gas lighting in the streets under the council's control.

Public lighting agreements have recently been entered into by the Urban District Council of Whaley Bridge and the Parish Councils of Chapel-en-le-Frith and Wormhill.

About 308 lamps are affected by a renewal of the contract for gas lighting in force in the area covered by the Lurgan Urban District Council.

Extensive improvements are being carried out in the lighting of Kirby-in-Ashfield where the Urban District Council has renewed its contract for gas lighting, and the lighting is being extended by the gas department.

About 305 lamps are covered by a renewal of the gas-lighting contract for the urban area of Glyncorrwg, South Wales. The lighting is to be improved under the new agreement.

Abercarn Urban District Council has received the necessary loan sanction of the Ministry of Health for expenditure on the installation of a number of modern gas lamps to improve the lighting on the more important roads in the district. Some of these lamps have twelve mantles, but the majority have four mantles.

These improvements follow on similar ones already carried out by the council, a number of the new four-light lamps having already been introduced. The reflectors used with them were designed with a view to compliance with the Ministry of Transport's recommendations on street lighting. It is reported that excellent visibility has been obtained.

Improvements have been recently carried out in the lighting of Cirencester and Stratton the lighting being by gas. In certain streets the number of mantles per lamp has been increased and reflectors have been fitted to an increasing number of units.

Lighting of "Winter Cavalcade"

With reference to the note that appeared on this subject in our last issue (January, 1939, page 18), we learn from the Strand Electric and Engineering Company, Ltd., that a number of arc lamps of different sizes and patterns were used from the lighting gallery, the most powerful being a new A.C. arc lamp designed by the company, and to be placed on the market very shortly.

This new type of lantern which gave an exceptionally bright light, was run off the A.C. mains through a resistance at 60 amps. When used in connection with a special transformer now in course of development the lantern will, however, require only 25 amps, and ballast resistance will be eliminated.

We hope to publish fuller particulars shortly.

Obituary

Professor G. B. v.d. Werfhorst

We learn with deep regret of the death of Professor G. B. van der Werfhorst, one of the leading authorities on lighting in the Philips organisation, and a professor at the University of Utrecht. Professor van der Werfhorst was a member of the Illuminating Engineering Society. On several occasions participated in its meetings and in those of the Association of Public Lighting Engineers. A paper read before the A.P.L.E. Conference at Cheltenham in 1936 aroused much discussion, and his displays of the latest forms of discharge lamps, etc., at I.E.S. meetings were always popular events. His enthusiasm for his subject and his genial disposition gained him many friends in this country.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 7, January, 1939.)

I.—RADIATION AND GENERAL PHYSICS.

34. The Fundamental Principles of Fluorescence.

Gorton R. Fonda. Elect. Engineering, 57, p. 677, December, 1938.

The author advances a theory for the fundamental action which gives rise to fluorescence, comparing fluorescence of liquids and solids with resonance radiation of a gas or vapour at low pressure. He concludes that fluorescence is always due to some very slight irregularity in the composition of the material; for example, by a low percentage of impurity or abnormal crystal structure. S. S. B.

III.—SOURCES OF LIGHT.

35. Fluorescent Mercury Discharge Lamps.

J. Guanter Bull. Assoc. Suisse des Electriciens, XXX., 2, p. 33, January 20, 1939.

The paper consists mainly in a survey of progress in mercury discharge lamps, in the course of which the use of fluorescent materials is reviewed. Mention is also made of combination units in which mercury lamps and filament lamps are associated in the proportion 5:1. J. S. D.

36. Fluorescent Daylight.

W. P. Thayer. Magazine of Light, VII., No. 8, pp. 20-21, year end, 1938.

Details of colour-matching units used in an American hosiery factory are given. One hundred and fifty 30-w. daylight fluorescent lamps are used. C. A. M.

37. Fluorescent Lamp Has Steady D.C. Arc.

Anon. El. World, 110, p. 1,742, December 17, 1938.

Details are given of a 100-w. tubular fluorescent lamp, introduced in America, designed to give 50 lumens per watt of bluish-white light, when operated on a full-wave rectified D.C. circuit, resulting in 90 per cent. power factor. There is no over-current at starting, and the lamps may be used on 115 volt or 230 volt, 60 cycle circuits. Strobscopic flicker is eliminated.

38. Cooler Foot-Candles.

M. Luckiesh. Magazine of Light, VII., No. 8, pp. 23-24, year end, 1938.

The approximate relative radiant energies per foot-candle are given for present daylight sources. C. A. M.

IV.—LIGHTING EQUIPMENT.

39. Indirect Luminaires.

Ward Harrison. Magazine of Light, No. 8, pp. 11-13, year end, 1938.

A comparison is made of the various types of indirect lighting fittings from the aspects of resulting illumination and of eye comfort. Particular attention is given to units employed in the coffer system, and full details of a typical coffer are given. C. A. M.

40. Lighting Developments in 1938.

W. Schmidt. Licht u. Lampe, p. 7, January 12, 1939.

The developments reviewed relate mainly to electric lamps. Gas-filled 25-w. and 40-w. "candle" lamps, with coiled filaments, are reported. The main advances have been in discharge lamps, on lines similar to those in this country. Gaseous tubes yielding white light are used in preference to combinations of tubes giving red and green light, etc. Lamps utilising fluorescent materials and special units furnishing u.v. radiation and little visible light have been developed. In the design of fittings economy in the use of metals has been a dominating factor, metallic coatings being given to other materials or fittings constructed of wood, porcelain, and glass. J. S. D.

41. Lighting by Coffer System.

K. Staley. Magazine of Light, VII., No. 8, pp. 6-7, year end, 1938.

Details are given of a lighting scheme in a bank, in which the lighting is provided by the assembly of a number of rectangular coffers, each using a 300-w. inside frosted lamp. C. A. M.

42. Transmitted Light Signs.

Francis M. Falge. Magazine of Light, No. 8, pp. 14-15, year end, 1938.

Suggestions for the use of luminescent lamps for advertising purposes are made. Recommended brightnesses are given. C. A. M.

43. Further Study in the Influence of Filament Form on Beam Characteristics with Deep Paraboloids.

G. Mili. Am. Illum. Eng. Soc. Trans., 10, pp. 978-985, December, 1938.

Data presented show the effect on the beam-spread and maximum candle-power from a deep paraboloidal reflector varying the proportions of a single coil filament, mounted on the axis of the reflector and at right angles to it. In general, for a given length of wire, if the length of the filament is increased by reducing the mandrel diameter, the candle-power is increased. If the length is increased by increasing the pitch, the candle-power is reduced. J. S. S.

44. Light Reflection from Painted Surfaces.

J. A. Meacham. Magazine of Light, VII., No. 8, pp. 29-31, year end, 1938.

A suggestion for the specification of the reflection properties of a paint is made in terms of the quantity required to obliterate completely a given pattern in black-and-white. C. A. M.

45. This Year's Progress in Illumination.

Various Authors. Am. Illum. Eng. Soc. Trans., 10, pp. 918-963, December, 1938.

A complete summary to technical developments in America during the past year is given. J. S. S.

46. Light and Architecture.

Anon. Am. Illum. Eng. Soc. Trans., 10, pp. 883-890, December, 1938.

Some representative architectural lighting schemes are described with photographs. J. S. S.

47. Illumination Levels and Eye Comfort Conditions.

W. B. Lancaster, M.D. Am. Illum. Eng. Soc. Trans., 10, pp. 964-977, December, 1938.

The subjective factors conducive to comfort in seeing are discussed. Illumination values for maximum comfort in all conditions cannot be given, since comfort depends both on the state of the eyes and on the work to be done. J. S. S.

48. Seeing.

"*L. E. C. H.*" Elect., 121, pp. 757-758, December 23, 1938; Elect., 121, pp. 789-790, December 30, 1938; Elect., 122, pp. 13-14, January 6, 1939; Elect., 122, pp. 41-42, January 13, 1939.

A further group of four articles is given on seeing, with particular reference to colours. C. A. M.

49. A Visual Phenomenon.

W. D. Wright. Nature, Vol. 142, No. 3,609, p. 1163, December 31, 1938.

A visual after-image phenomenon reported by Dartnall (Nature, Vol. 142, p. 1000) has been shown to be non-existent in those observers who have been found to give a delayed recovery curve after light adaptation. R. G. H.

50. Lighting of Municipal Buildings.

Anon. El. Rev., Vol. CXXIII., No. 3,188, p. 927, December 30, 1938.

A fully illustrated description of a number of special lighting installations for civic buildings. The leading lighting engineers strongly advocate close co-operation with the architect at the earliest possible stage in the design of a new building. R. G. H.

51. A Seaside Hotel Installation.

Anon. El. Rev., Vol. CXXIII., No. 3,188, p. 930. December 30, 1938.

Describes, with a photograph, the lighting installations in the Ocean Hotel, Saltdean. Cornice lighting is the main feature of the installation. R. G. H.

52. Albany Hotel, Denver.

Ray N. Hankins. Magazine of Light, VII., No. 8, pp. 8-9, year end, 1938.

An unusual feature in the lighting equipment of the Albany Hotel, Denver, is the recessing of fittings wherever possible into the ventilating ducts above the ceilings. Louvred fittings with silvered bowl lamps are used extensively. C. A. M.

53. Modern Lighting for To-day's Power Plants.

Davis H. Tuck. El. World., 110, p. 1594. December 3, 1938.

Some details, with illustrations, are given of the lighting provided in a number of different positions in various American power plants. S. S. B.

54. Unidirectional Lighting of Roads.

Anon. El. Times, 94, pp. 769-770, December 8, 1938.

An illustrated account is given of an experimental street-lighting installation designed specifically for double carriageway roads. The light from the fitting was directed against the traffic direction so that the contrast between objects and road surface was high, there being no light falling on the object. W. R. S.

55. Street Lighting in Dublin.

Anon. El. Rev., Vol. CXXIV., No. 3,189, p. 34, January 6, 1939.

Describes the new lighting of some of Dublin's main thoroughfares. Marble-finish concrete columns are used. The thoroughfares are unusually wide, so that a considerable degree of asymmetry in the light distribution has had to be employed. R. G. H.

E.L.M.A. Lighting Service Bureau

Mr. H. Lingard now appointed Manager

It will, perhaps, come as a bit of a shock to many members of the Illuminating Engineering Society and others who have so often enjoyed the hospitality of the E.L.M.A. Lighting Service Bureau to learn that Mr. W. J. Jones will no longer be on the spot as manager. Mr. Jones has been associated with the bureau from its commencement, and has superintended its development with a skill and enterprise to which all will bear witness. He has now been appointed deputy director of the Electric Lamp Manufacturers' Association. His many friends will feel confident, however, that his interest in illuminating engineering, which he has served so well, will be fully maintained.

Mr. H. Lingard, who is almost equally well known in the field of illumination, now becomes manager of the bureau. The general impression will be that no better choice could have been made. He, too, has done good service to illuminating engineering and the Society in many ways. His excellent address to the Commercial Lighting Section at its opening meeting this session will be fresh in the minds of our readers

Architects' Conferences on Lighting

A series of four conferences on lighting for architects has been arranged to take place at the E.L.M.A. Lighting Service Bureau on February 1, 8, 15, and 22. The following subjects appear on the list: "The Relation between Natural and Artificial Illumination in Architecture" (Mr. R. O. Sutherland); "Research and Developments in Electric Light Sources" (Mr. L. J. Davies); "The Scientific and Practical Design of Lighting Equipment" (Mr. G. H. Wilson); and "Illumination Problems in Domestic Architecture" (Mr. H. Lingard). In each case an architect has consented to open the discussion.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 495,035. "Improvements in or Relating to Illuminating Systems for Optical Projection Apparatus."

The British Thomson-Houston Company, Limited, and Eade, S. R. Dated May 4, 1937.

According to this specification a long narrow light source is used for optical projection by an optical system which provides different ratios of magnification in two planes at right angles between the source and an image thereof so that the lengthwise dimension of the image of the source is relatively reduced and its width-wise dimension is relatively expanded. A mirror or reflector of elliptical cross section and a cylindrical condenser with their axes at right angles may be used.

No. 495,591. "Improvements in High-Pressure Metal-Vapour Lamps and in Means for Operating Them."

The General Electric Company, Ltd. (*Communicated by Patent Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.*) *Dated September* 28, 1937.

According to this specification a source of light comprises a high-pressure metal-vapour discharge lamp having in series with it a ballast resistance of iron or like metal having a high temperature coefficient of resistivity immersed in an atmosphere of gas of high thermal conductivity and proportioned so that in normal operation the voltage across the wire is less than 25 per cent. of the total applied voltage and yet the wire forms substantially the whole of the stabilising impedance for the lamp, but provides substantially no light. This arrangement is said to be more efficient than the more usual arrangement of incandescent filament forming the stabilising impedance.

No. 495,623. "Improvements in or Relating to Carbon Arc Lamps."

Zeiss Ikon Aktiengesellschaft. Dated June 14, 1937. (*Convention, Germany.*) (*Patent of addition to No.* 471,647.)

This specification describes a variable rate carbon feed mechanism for an arc lamp which includes a coupling comprising a driving and driven member and a coupling member carried by the driving member and normally engaging the driven member. An adjustable cam or track or the like co-operates with the coupling member to cause periodic engagement and disengagement of the coupling member and the driven member to permit variation of the time of engagement

No. 496,097. "Improvements in or Relating to Means for Closing the Fuel Reservoirs of Hurricane Lanterns."

Nier, B. Dated May 15, 1937; *December* 10, 1937. (*Cognate Applications.*) (*Convention, Germany.*)

This specification describes an oil hurricane lantern of which the oil reservoir may be closed by a stopper or packing attached to the immersed end of the wick. In order to close the reservoir the wick is turned fully up.

No. 495,641. "Improvements in Lamp Enclosures."

The British Thomson-Houston Company, Ltd. Dated April 25, 1936. (*Convention, France.*)

According to this specification a lamp enclosure or envelope for operation while immersed in a liquid has an ellipsoidal reflecting surface and a hyperboloidal portion on the same axis and having an eccentricity equal to the refractive index of air to the liquid, the two portions having a common focus.

No. 495,731. "Improvements in or Relating to Electric Discharge Lamps comprising a Refractory Body adapted to be Heated to Incandescence by the Discharge."

The General Electric Company, Ltd. (*Communicated by Patent Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.*) *Dated August* 19, 1937.

In order to control the temperature of a body not forming a normal electrode of the discharge, but heated to incandescence by the discharge of a discharge lamp, this body is separated mechanically from both the electrodes, but is connected through a circuit comprising impedance and preferably external to the lamp to the main discharge circuit so that current may flow from the discharge through that body to at least one of the main electrodes.

No. 495,762. "Improvements in or Relating to Photo-Electric Control Systems for Machine Tools and other Machines and Apparatus."

The Associated Equipment Company, Ltd., and Jones, E. J. H. Dated April 14, 1937.

This specification describes a photo-electric control system for governing a predetermined succession of operations comprising a photo-electric cell connected in a control circuit of an electrically operated device and a shutter between which and the photo-electric cell relative movement takes place to control the admission of light to the cell in accordance with the desired succession of operations. The shutter has opaque and light transmitting portions of an appropriate extent to energise and de-energise the cell for periods corresponding to those during which operations in the succession are required to take place.

The invention is specifically described in relation to the control of automatic drilling machines to perform a sequence of operations.

No. 496,092. "Improvements Relating to the Lighting of Buildings."

Société Anonyme des Manufactures des Glaces et Produits Chimique de Saint-Gobain, Chauny and Cirey. Dated March 12, 1937. (*Convention, France.*)

In order artificially to illuminate a building without emitting visible light through the windows, the windows are, according to this specification, glazed with a medium totally absorbing certain luminous radiations, and light sources are used which radiate only those radiations. Various combinations of glazing medium and light source are given in the specification, e.g., a glass containing neodymium oxide and copper oxide in combination with a helium discharge tube.

Some Aspects of Modern Street Lighting

by

E. C. Lennox

(Summary of a paper read before the London Technical Group of the Electrical Power Engineers Association on January 10, 1939.)

Lighting of streets as a charge on the local rates has been sanctioned by legislation for over 100 years. It is strange, therefore, that only recently has this problem been the subject of national publicity. Street lighting, which is necessary during 47 per cent. of the year, should be treated on the same basis as water supply, sewerage, and transport. Its importance has been emphasised by the growth and greater volume of traffic during hours of darkness and by the alarming increase in the number of road accidents, which persists in spite of signs, signals, police patrols, speed limits, etc. Over 50 per cent. of the total occur during hours of darkness.

Brightness of Road Surface.

Following these introductory remarks the author entered upon a summary of the M.O.T. final report on street lighting and referred to the new B.S. specification, now in course of preparation. The difficulty of including road brightness, which is so dependent on extraneous factors such as nature of road surface, effects of weather conditions, etc., in a specification was explained, and photographs were presented to show how greatly this factor depends on positions of light sources. The brightness effect of each lamp has a general resemblance to the letter "T," diminishing to a point at the position of the observer and widest at a distance. The aim of the lighting engineer is to place his lanterns so that the bright "T" patches coalesce, forming an adequate and even road brightness, against which objects are seen in silhouette. The motorist is concerned mainly with the more distant views, since, travelling at 30 m.p.h., he would reach 200 ft. in 6½ seconds. Too long intervals between lanterns result in dangerous dark patches. Centre suspension tends to overlapping of bright images in the centre of the road, leaving the sides relatively dark. Staggering is therefore usually preferable. Lamps should be placed outside bends (because lamps on the inside would produce brightness patches which do not fall on the roadway), but the angle between two adjacent lanterns should not exceed 5 deg. if lanterns are mounted 25 ft. high and 200-500 ft. away.

The Design of Lanterns.

In the design of lanterns the adoption of a cut-off involves shorter spacing. The light from one lantern must reach at least as far as the base of the next lantern if dark patches are to be avoided. If the angle of light distribution is increased by 16 deg., i.e., from 70 deg. to 86 deg., the brightness patch is increased four times. This makes possible wider spacing and economy in posts, but has the drawback that increasing the light at these angles dazzles the eye. "Controlled cut-off" lanterns, in which the distribution between 70 deg. and 80 deg. is carefully controlled to give minimum glare, are therefore preferred.

With cut-off lanterns (having distribution limited to, say, 70 deg.) glare from distance sources is completely eliminated so that an impression of good visibility with relatively low surface brightness is secured. Close spacing, 90-100 ft., is, however, essential; otherwise a troublesome impression of intermittent glare as one approached each lantern is experienced.

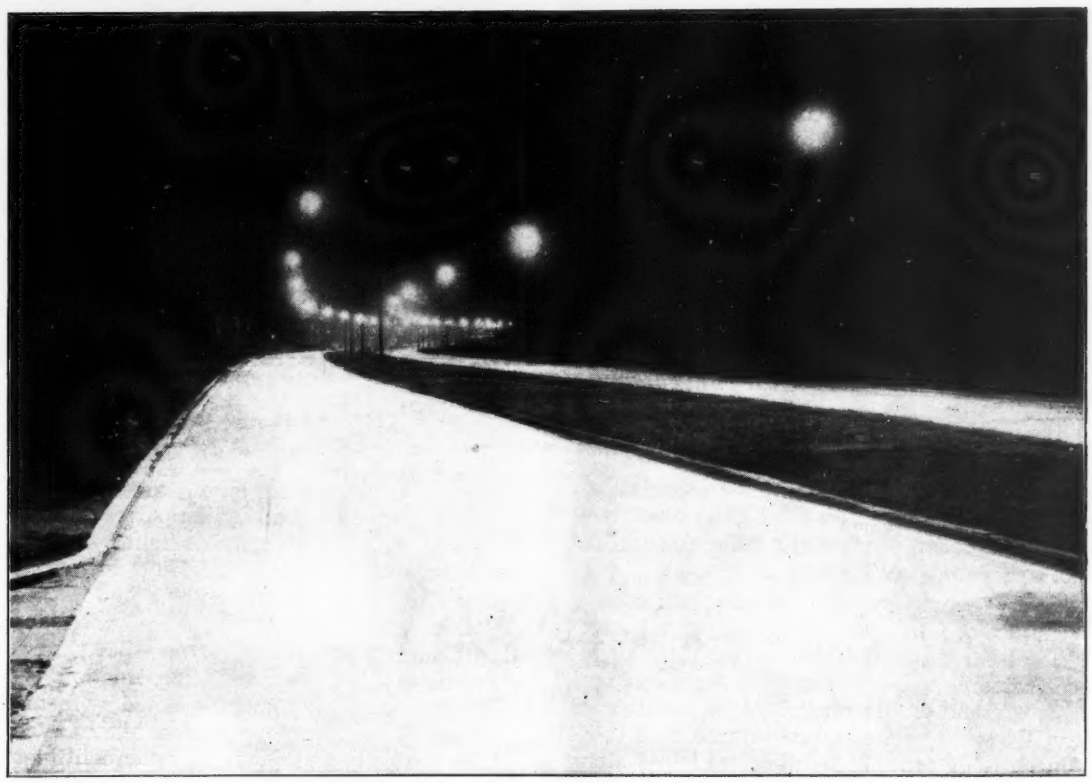
Comparison of Sodium and Mercury Lamps.

In the next section of the paper the author reviewed recent developments in electric discharge lamps, discussing in turn sodium and mercury types and presenting a table showing efficiencies (for pressures of 1 atmosph. upwards) of 36 to 60 lumens per watt. Much has been said regarding the comparative merits of mercury and sodium lamps. Both have high efficiency and long life under normal conditions, but both need auxiliary equipment and have high initial cost, and both are deficient in red rays—giving unnatural colour effects. On a lumen-for-lumen basis there does not appear to be any difference in visibility effect due to the nature of the spectrum. The use of fluorescent materials to correct the spectrum is, however, a possible advantage of mercury lamps which sodium lamps do not enjoy.

The Question of Cost.

The latter part of the paper is devoted to a comparison of costs. A table is presented showing that if energy is taken at 0.8d. per unit the cost of lamps forms 13.5 to 19.2 per cent. of the total costs for filament lamps, 28 to 42 per cent. for sodium lamps, 29.5 to 31 per cent. for mercury lamps, and 31.7 per cent. for fluorescent lamps. The capital cost is also greater for the discharge lamps, being of the order of £22 15s. to £25 5s., as compared with £16 10s. to £18 10s. for filament lamps. Supplementary tables give figures for the average cost per 100 lumens per annum for various types of lanterns equipped with metal filament and discharge lamps. Such figures very between the limits of 2s. and 7s. It is inferred that the use of small wattage discharge lamps offers little or no advantage in cheaper illumination over metal filament lamps of equivalent lumen output, and that the metal filament lamps give the lighting engineer a much better light maintenance curve. The border line at which metal filament lamps and discharge lamps have equal cost per 100 lumens per annum for 3,680 hours' lighting is found to be 0.4d. per unit for 400-watt mercury lamps, 0.6d. per unit for 170-watt sodium lamps, 7d. per unit for 250-watt mercury lamps, 8d. per unit for 80-watt sodium lamps, and 2s. per unit for 80-watt mercury lamps. The author emphasises the importance of a reduction in the heavy cost of replacements of discharge lamps, which at present forms too high a proportion of the annual cost of street lighting.

YORK AVENUE, JARROW



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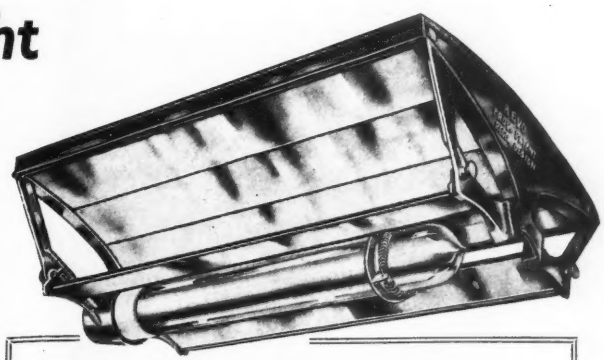
Here is another triumph for the well-known REVO C9325 Silvered Mirror Sodium Street Lighting unit. Look how evenly the entire surfaces of the dual-carriageways of this modern highway are lighted. This is a characteristic feature of the REVO C9325 fitting—to put light on the roadway, without glare. Profit by the judgment of the authorities responsible for this, and the many other miles of street lighting, for which REVO C9325 fitting has been chosen

Send for further particulars and sample unit to test



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The Silvered Mirror Reflector fitting with auxiliary silvered mirror light source screening reflectors. Made in sizes for use with 50W., 65W., 100W., and 150W. Sodium Lamps.

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The choice of systems of lighting obviously demands special knowledge and advice from the expert.

THE NEED FOR COMPETENT ADVICE.

In conclusion the author again emphasises the importance of lighting authorities having available the services of a competent street lighting engineer, discussions with whom usually merely involve agreement on details of cost and charges. When no such engineer is available it is often necessary to plan and present complete schemes of lighting, to arrange demonstrations, and to furnish detailed estimates of the running charges for various systems and types of lamps. Special demonstrations, which commonly remain in situ for considerable periods, may cost hundreds of pounds. Visits to completed installations in the district or in outside areas are relatively much more economical. It is most difficult to handle those areas where the lighting is dealt with piecemeal and new quotations must be made every time a new road or area is to be lighted. Such quotations tend to resemble a "Dutch Auction." No gas or electric supply authority can possibly put forward their best street lighting scheme when tenders are called for without a properly prepared specification.

Under the present system of administration a lighting authority must meet the cost of all street lighting in its area, irrespective of the relation between the rateable value to the route length of residential streets and traffic routes. As a result each authority lights the section of route according to its funds, and varying types of lighting are found along any such traffic route. Where lighting of roadways is necessary, the author concludes, it should be considered as part of the normal roadway maintenance, and its cost should be met by similar means, i.e., be subject to similar grants, control, and supervision.

Lighting on the London Wool Exchange

An Opportunity for Illuminating Engineers

"The sales of wool at the London Wool Exchange had to be postponed yesterday because the light made it impossible for valuers to make the inspection of samples which they always make on the spot." (From "The Odd Spot," "Daily Express," Jan. 26, 1939.)

Sheffield Illumination Society

We have before us the syllabus of the Sheffield Illumination Society for the current session. Readers may be reminded that this Society, founded by Mr. J. F. Colquhoun, the public lighting engineer for Sheffield, exists primarily for the benefit of the staff. It has kept up its programme, year by year, since 1925, and always manages to provide a skilful blend of instruction and entertainment. The present programme provides for talks on store-keeping and testing-work, and a demonstration in the Photometer Room. There are also evenings devoted to travel films and a visit to the Observatory at Weston Park. We notice one item that figures for the first time—a cricket match versus the Leicester Lighting Dept. on June 24. It is not stated whether the sides will be captained by the respective public lighting engineers of the two cities, but, in any case, it should prove a sporting event.

A Modern Food Factory

The new factory and research laboratories of Messrs. Bengers Food, Ltd., at Holmes Chapel, Cheshire, furnish a good example of modern methods in layout, general design and lighting. In view of the nature of the work, hygienic cleanliness and purity of the product are of obvious importance. Walls and floors are tiled or otherwise treated to give a bright and pleasing effect, and the whole of the premises are of steel-framed construction.

The lighting throughout is effected by Siemens gas-filled lamps in Benjamin reflectors of the Glasteel and R.L.M. patterns and Siemens Sphere fittings. The accompanying pictures give a good idea of the general effect of this "sufficient and suitable" lighting, which is designed to conform completely with all the requirements of the recent Factory Act.

The lighting of the roadway adjacent to the main entrance is again of an essentially modern character. Siemens "Sieray-Dual" discharge lamps (which utilise a combination of a filament and a discharge tube in series) in Benjamin reflectors have been adopted, and even and well-diffused light over the whole roadway has been secured.

Other features of interest are the wiring, which is executed throughout on the Siemens Stannos system —a surface system in which, nevertheless, the leads are very inconspicuous. Electrical equipment forms a feature of the canteen. A private automatic system serves the offices and works.

Electricity is taken in bulk from the North Wales Power Company into a sub-station on the premises.

NOTES ON ILLUMINATING ENGINEERING AT HOME AND ABROAD

(Specially Contributed—H. L. J.)

Switzerland.

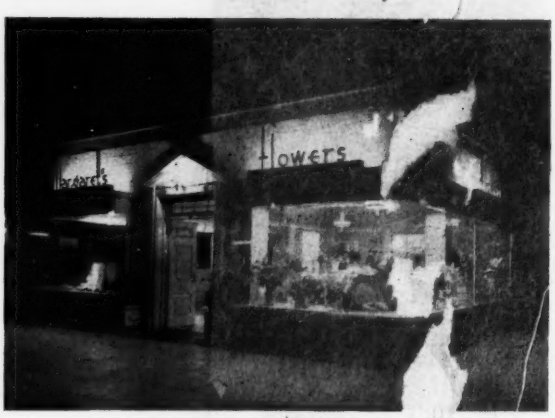
Another development in Geneva, sponsored by the local electricity undertaking, in November last, was the "Salon Lumière." The display included demonstrations of modern decorative lighting, a series of posters revealing the historical development of light sources, and the response of the eye to light, examples of show window lighting, and a comprehensive display of different types of fittings. Opportunities were afforded for visitors to determine the illumination they preferred for various purposes. Occasional lectures were also arranged. During the three weeks for which the exhibition was open about 46,000 people attended, which—in view of the fact that a considerable part of the exhibition was of a somewhat technical character—seems to have been a good response.

Germany.

In a contribution to last year's Conference of the German I.E.S. (reported in "Das Licht"), L. Schneider investigates the advantages of better lighting in the industrial field. He points out that good industrial lighting is not only a safeguard against fatigue of the eyes and other demands from the medical point of view. It is also an established fact that efficiency of vision is increased by better lighting, and that it aids many psychological reactions which have a direct influence on speed and efficiency in work. In the case of mines the switching over from the mere use of hand lamps to the installation of a lighting arrangement at fixed points, giving a general illumination, resulted in an increase in the particular mine of 25 to 30 per cent. This is attributed partly to the fact that good general illumination promotes team work whereas the use of hand lamps alone gives an impression of isolation. Another advantage of good general illumination in addition to local lights is the considerable saving in time lost in production by searching for tools, closer inspection of the work, etc. In the case of tile production, work not necessitating fine details of observation and therefore where the influence of lighting should be less evident, an increase in illumination from 0.7 ft.c. to about 18 ft.c. resulted in a 12 per cent. increase in production. In the case of reading and writing, classified as fine work, increased illumination increases speed. Investigations at a postal sorting office, where the quick reading of addresses is essential, had shown that an increase of illumination from 3.75 to 8 ft.c. increased the speed by approximately 11 per cent.

The disadvantage of glare is proved by investigations in a paper sorting department where the degree of illumination produced by 300-watt lamps was quite satisfactory, but where nevertheless, there was a discrepancy between results of work in daylight and artificial light. During the day 26.8 sheets per minute were sorted, and in artificial light 23.3. Investigations proved that glare was the cause of the deficiency. This defect having been remedied, but the same wattage maintained, the rate of sorting went up to 28.4 sheets per minute, being thus even better than by daylight.

United States.



The picture above, which, like the o tilised with these notes last month, appeared in I. Vetro," relates to a flower shop in California. Two points of interest may be noted. There is firstly the utilisation of jointed glass windows giving an uninterrupted view of the contents of the window. Secondly, there is the somewhat unusual silhouette effect obtained from the sign above by floodlighting the area immediately behind so as to produce a luminous background.

France.

A somewhat special fitting for tennis court illumination has been used for the first time on a large scale in the newly built "Stade Pierre de Coubertin," an indoor sports club. The fitting is designed with the double purpose of giving a good light distribution all over the room, not only on the working plane but on the moving ball itself. It consists, therefore, of two essential parts, a reflector, approximately 3 ft. in diameter, with a white-painted matt diffusing surface, and a highly polished parabolic projector. A mirror system enclosing the actual bulb directs the major part of the light emitted on to the parabolic projector, thus effecting a well-controlled beam of light. But sufficient light is emitted from the diffusing reflector to diminish sharp contrasts. A small portion of the light is also directed behind the reflector, brightening up the background. By this arrangement it is contended, glare or fatigue due to excessive contrasts is avoided at all angles of view.

South Africa.

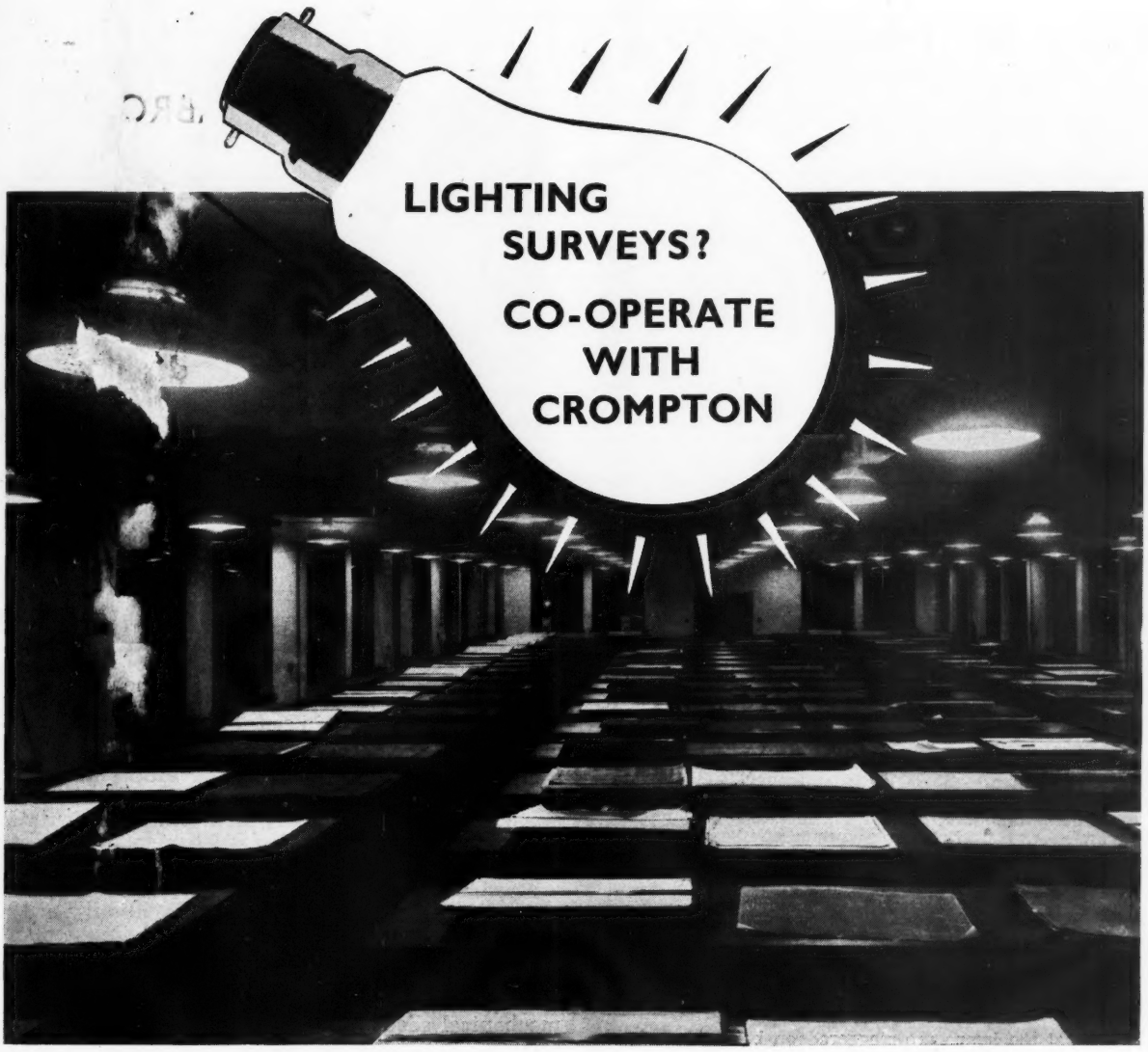
A Belgian electric lamp manufacturing concern is stated to be erecting a factory at Port Elizabeth, South Africa. The plant is designed to produce 3,000,000 bulbs per annum. The approximate consumption of bulb lamps by the South African market at present is 9,000,000 per annum, all at present imported. It is anticipated that production will commence in the second part of this year.

(*New Zealand El. Journal.*)

New Zealand.

On the occasion of New Zealand's Centennial Exhibition, in February, 1940, the scope of the Annual Conference of the New Zealand Institution of Engineers is to be extended by inviting the attendance of delegates from all English-speaking nations.

(*New Zealand El. Journal.*)



"Lighting for Messrs. Dorman, Long & Co. Ltd., Constructional Drawing Office, Middlesbrough, designed by their own Lighting Engineers in conjunction with the Crompton Illumination Service."

Photographed by kind permission of Messrs. Dorman, Long & Co. Ltd.

Industry needs more light. The urgency of that demand has increased in recent months. The new Factories Act imposes lighting regulations on more than 278,000 industrial premises and the Act has been strongly supported by E.D.A., E.L.M.A. advertising.

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How efficiently their work will be done may be judged from the photograph above—an installation typical of many carried out in this way. As an expert you will appreciate that such skilful planning used in conjunction with Crompton lamps provides the best possible lighting for modern high speed working conditions.

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Electric Street Lighting

Mirfield.—Two-and-one-third miles of the Huddersfield-Dewsbury road passing through Mirfield are to be lighted electrically. Previously only one-third of the length was thus lighted.

The Easthorpe section is to be provided with fourteen 250 watt mercury discharge lamps, and the remainder to be lighted by 200 and 300 watt filament lamps.

The Lothians.—In the area of the Lothians Electric Power Company there are fifty-seven lighting authorities with 1,572 lamps—an average of twenty-seven to twenty-eight lamps per village. Recent improvements and additions are:—

Oakbank—Housing scheme lighting extended by 7—50 watt sodium discharge lamps.

Polbeth—A new scheme of 30—65 watt sodium discharge lamps on 1¾ miles of road.

Port Seton—Eight 50 watt sodium lamps.

Whitecraig (a new village)—Six 150 watt sodium lamps.

Bilston—Five filament lamps in housing scheme.

East and Mid Calder—Fourteen 65 watt sodium lamps.

Pumpherston—Erection of 8—50 watt sodium lamps in hand.

East Saltoun—Four 60 watt filament lamps.

Tranent—Six sodium lamps on housing scheme.

Preston—Seven more 60 watt filament lamps on the housing scheme.

Heslin—Twenty-seven 60 watt filament lamps have replaced the gas-lighting system.

Ramsey, Hunts.—Sixty-seven electric street lamps (fifty-two 100 watt lamps, eight 150 watts, and seven 200 watt) have been installed for the lighting of Ramsey. The annual cost of the scheme amounts to £284 6s., including maintenance and lamp renewals. Reflecting equipment is used throughout. Side street lamps are mounted at 15 ft. 6 in. Those in the main streets are suspended between buildings or erected on columns.

Peterhead.—There are now 215 mercury discharge lamps in commission at Peterhead. These consist of: 83—250 watt lamps in bowl refractor lanterns at 25 ft. mounting height; 15—125 watt lamps in refractor lanterns at 21 ft. mounting height; and 117—80 watt lamps in refractor lanterns at 11 ft. 6 in. mounting height.

In general the lamps are staggered on both sides of the road, the 250 watt and 125 watt lamps spaced at approximately 150 ft., that of the 80 watt lamps varying from 120 to 150 ft.

Tyneside and the North-East, Gateshead.—The corporation has instructed the North Eastern Electric Supply Company, Ltd., to provide thirty-four 150 watt sodium discharge lamps on Saltwell-road from Bensham Bank to South Dene Towers, a section of road not previously lighted by electricity. The installation is to be extended at a later date. Electric street lighting is provided on Gateshead's new housing estates.

Jarrow.—Until recently, when a sodium installation was provided on York-avenue, there was no electric street lighting in Jarrow.

The corporation has now decided to instal electric street lighting on their new housing scheme, and a substantial section of the shopping centre is to be lighted by 400 watt mercury discharge lamps.

Ashington, Northumberland.—Following a successful trial street lighting scheme, the council is to instal 400 watt mercury discharge lamps in Station-road.

Hebburn.—Work on the new installation at Hebburn is proceeding apace, the council having decided to retain electricity.

Felling.—The Urban District Council has built many extensive housing schemes during the past few years, the lighting being carried out with 100 or 150 watt filament lamps at 120 ft. spacing. A trial is now to be made with 80-watt mercury discharge lamps with a view to meeting the lighting needs of future residential roads.

Consett.—By recent boundary changes Consett has absorbed parts of neighbouring urban districts. Street lighting in the original Consett Urban District is all electric. The council have recently improved their lighting equipment and extended the lighting season.

Newcastle.—Newcastle Corporation has installed centralised control on two housing estates, and contemplates the extension of the practice to others. Centralised control systems are already operating at Hebburn, South Shields, Thirsk, Sowerby, and Durham City. The value of these schemes in event of emergency is well recognised.

Lighting an Isolated Plant

Right out in the country, at Ashover, in Derbyshire, is a tar macadam plant belonging to the Clay Cross Company, Ltd. The plant is completely isolated. In order to light it the mains had to be carried for a considerable distance across open country, and economy in consumption was, therefore, of paramount importance. For this reason sodium lighting was chosen. As a result the lighting load for the whole of the plant—exterior and interior—amounts to only 735 watts, as against a calculated load of nearly 3 kw. if ordinary (filament) lamps had been used to obtain the same degree of illumination.

Another factor which helped to confirm the superiority of sodium for this installation was the tremendous vibration caused by the mixing plant, which is housed in the upper floor of the building. Since they have no filament, gas discharge lamps are largely immune from damage due to vibration and mechanical shock. In point of fact, all the original sodium lamps are still in use after nearly twelve months' service.

The whole installation was planned and the work supervised by Mr. R. W. Barnes, the chief electrical engineer to the Clay Cross Company, Ltd.; 85-watt "Philora" sodium lamps were used in S.O.R.A. dispersive reflectors, the whole being supplied by Philips Lamps, Ltd., Nottingham branch.

The Dark Days

As likely as not before breakfast is over the grey light darkens, and through a mist of fog we go to the kitchen and find the daily help washing up in a twilight that suggests the kingdom of Pluto.

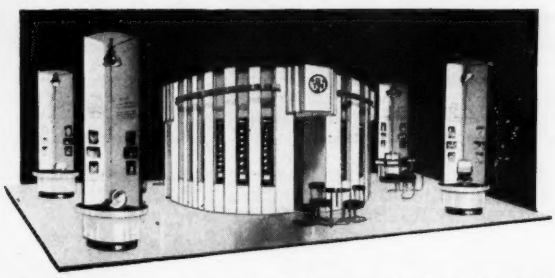
"Do put the light on," we say, feeling glad that we can be generous with electricity at a ha'penny a unit, and back comes the answer—for we have given virtue an opening—"It's all right, I can manage. I never like to waste the light."

Then we switch on the light ourselves, knowing that broken or half-washed pots are the ultimate result of managing in the dark.—"Daily Express."

E.A.W. London Branch Programme

The Spring and Summer programme of the E.A.W. London Branch is a skilful blend of entertainment and instruction. The Annual Conference is at Cardiff during May 3-6. The London programme includes visits to the London Fire Brigade H.Q., the Royal Masonic Hospital, The Mansion House, the Osram G.E.C. Lamp Works, and the Holophane Theatre—where a three-act play by the London Branch Dramatic Circle has been arranged.

B.T.-H. at the B.I.F.



An artist's impression of the circular stand of the British Thomson-Houston Co., Ltd. (Cb. 505 and 404) at the British Industries Fair, Castle Bromwich. The columns are glazed and internally illuminated, and the four supplementary towers carry suspended lanterns. The interior of the stand serves as an office, but also houses interesting exhibits including fluorescent flowers glowing in the radiation from concealed Mercra u.v. lamps.

The Illuminating Engineering Society (U.S.A.)

Notes on the Current Transactions—January, 1939

NEWS: The Texas State Board of Health intends making use of *the School Lighting Code issued by the I.E.S. as a guide in setting up bases for rating lighting systems of schools* under their jurisdiction, in addition to various items already covered from the health standpoint. *At the U.S. National Lighting Committee's session*, on November 29, *Mr. P. S. Millar, of the Electrical Testing Laboratories, New York, was re-elected President*, and G. H. Stickney, Secretary-Treasurer. A. A. Brainerd was elected to the newly-created office of Executive Secretary.

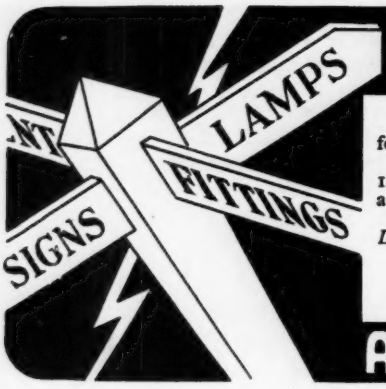
SUBJECTS OF PAPERS: "*Characteristics of Fluorescent Lamps*," by G. E. Inman, contains a complete survey of the data referring to construction and working conditions of the newly-introduced "Lumiline" discharge lamp, with fluorescent coating.

"*Lighting for the Machining of Small Metal Parts*"—investigations carried out by the Committee on Industrial and School Lighting." Chairman, H. B. Dates. Visual tasks involved in the use of tools for metal production are investigated, in general, by putting forward three questions—"What must be seen?" "How is it seen?" and "What quantity and quality of lighting will provide the most efficient, safe, and comfortable seeing conditions?" One distinctive problem is the discrimination of detail upon plain or curved metallic surfaces. Divisions on scales and micrometer calipers, for example, can be read most easily under diffusing light-sources with comparatively low brightness. The use of diffused light on the largest possible scale is recommended. Where circumstances render this impracticable small sources mounted relatively close to the work, in addition to good general illumination, should be used.

"*Effect of Temperature on Fluorescent Lamps*," by J. W. Marden, N. C. Beese, and G. Meister. The variation in efficiency of standard tube type discharge lamps, caused by variations of surrounding temperatures, is of importance, particularly when lamps are used outdoors. The light output of the lamp proved is low at 0°C., and falls again rapidly at 60°C., with the maximum at about 45°C.

"*Light Reflection from Painted Surfaces*," by J. A. Meacham. This paper studies the determination of reflection and "hiding power" properties of painted surfaces which are of considerable importance, especially when indirect illumination is applied. Transmission, hiding power, and reflection depend on the thickness of the film and the nature of its surface (glossy or matt). The specific quantity of paint used and gallons per area treated form a practical basis for determination of thickness. Whiteness, in the ultimate and ideal sense, is 100 per cent. brightness, or light reflection. There is probably no surface in existence possessing this ideal quality, but it is approached in the case of magnesium oxide. The best white paints available have a reflecting power between 87 and 90 per cent.

"*Measurement of Diffusion*." Progress Report of Sub-Committee on Diffusion of the Committee on Characteristics of Illuminating Materials. Chairman, W. F. Little.



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BENCH, CUBE, STREET and PORTABLE TYPES

FOR CANDLE-POWER AND ILLUMINATION TESTS

EVERETT EDGCUMBE Colindale Works LONDON, N.W.9

Index to "Where to Buy"

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 46—48)

New Fluorescent Electric Discharge Lamps

Rather more than a year ago the 400 watt "fluorescent" mercury discharge lamp made its appearance. Its main feature was the use of a special bulb coated with fluorescent powder, which converts the ultra-violet radiation present in the mercury spectrum into visible light. A variety of colours can be obtained by suitable choice of the powder. In the case of the 400 watt lamp powder is used which emits orange-yellow light. The blending of this with the bluish-white light from the discharge itself results in a light containing 6 per cent. of red, as compared with only 1-1½ per cent. of red in the ordinary 400 watt mercury lamp. The initial efficiency of the lamp is, however, reduced from 45 to 38 lumens per watt, because the extra light derived from the fluorescent powder does not fully compensate for the obstruction to visible light.

Efforts have since been made in the laboratories of the E.L.M.A. companies to apply the same principles to other lamps.

As a result fluorescent lamps of 80-watt and 125-watt sizes were introduced on February 1. In this case the quartz inner tube transmits ultra-violet radiation so freely that the obstruction of light is balanced by the gain in light from the fluorescent material. The efficiency is thus approximately the same as that of an uncorrected lamp.

In order to avoid a rise in temperature such as might destroy the stability and efficiency of the powder, bulbs somewhat larger than those for the uncorrected lamps are necessary. The 80-watt lamp, with an overall length of 178 ± 1.5 mm. and a bulb diameter of 110 ± 1.5 mm., approximates in size to the 300-watt tungsten lamp, whilst the 125-watt fluorescent lamp, with a length of 233 ± 7 mm. and a diameter of 130 ± 1.5 mm. approximates to the 500-watt tungsten size. The cap of the 80-watt lamp is a 3-pin B.C., but the 125-watt lamp is fitted with a standard G.E.S. cap.

The price of the 80-watt fluorescent lamp is 32s. 6d. and of the 125-watt lamp 40s. The lamps are expected to prove of considerable value where colour correction is of importance.

Simultaneously with the introduction of these lamps a reduction in the list prices of the uncorrected electric discharge lamps has been made, the price of the 80-watt lamp being reduced from 30s. to 25s. and that if the 125-watt lamp from 35s. to 30s.

Board of Trade Announcement

Key Industry Duty

The Board of Trade have received applications under Section 5 (5) of the Finance Act, 1936, for a licence to import free of duty the following:

(1) One S.I.P. universal measuring machine type MUL 1000, measuring lengths up to 40 in., elements of threads up to 5 in. diameter, and checking tapers and solids of revolution, reading to 0.00005 in. in length and 5 minutes of arc, and a universal measuring table and accessories therefor. (I.M. 261/39.)

(2) One neon discharge tube capable of operating with a current of approximately one micro-ampere, for demonstrating the negative layers of Holst and Oosterhuis, and one neon discharge tube with variable electrode separation for demonstrating the development of the positive column. (I.M. 5143/38.)

Any representations that similar apparatus is made, or is likely to be made within a reasonable time, in the United Kingdom or elsewhere in His Majesty's dominions, should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from the date of this notice, furnishing details of such similar apparatus and quoting the above references.

Board of Trade, January 23, 1939.

Incorporating "The Illuminating Engineer."

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Principal Contents:

Research

THIS is what many of us, starting in life, hope that we shall be called upon to do—to make some great discovery, invent some new process, of great benefit to mankind—surely the most solid and enduring title to fame.

But in these days it is given to few to achieve, as individuals, great discoveries. Advances tend more and more to be the result of patient team work, in which many take a share.

Last month members of the Illuminating Engineering Society were treated to a delightful and informative description of work of this kind. The address given by Mr. Warren, in the Lecture Theatre of the B.T.H. Research Laboratories, was packed with good things. At the end of his lecture Mr. Warren made generous acknowledgment of the services of his staff.

There are other centres of research in the lighting industry where similar good work is being done. Much of it naturally has a practical bent. Research must pay its way. But much has also a general bearing. All credit to those who do not hoard such knowledge but let it become known, to the general benefit.

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